

HalfCat Mojave Sphinx Sinnoh Sphinx+ Test Stand

February 2025

Test Stand Overview

We have been testing long 4" (98mm) motors out at FAR using the same basic test stand design for 8+ years, so for our Mojave Sphinx we just made small modifications. We've had some huge APCP motors cato without "going dynamic" and leaving the stand like the Chinese Tianlong-3.

For our Mojave Sphinx version we'll explain the design in two parts: 1) the test stand that bolts to the I-beam at FAR and 2) the "cat hat" topper we put on the rocket to protect the fuel bulkhead and secure it to the stand.

The Test Stand:

Our test stand ("rig") is just three parts and the load cell:

- A 55" x 8" x .25" aluminum backplate
- A 6"x6" x .4" steel 90 degree bracket (ours is 10" wide but only needs to be 6" wide)
- A 4" dock slider used for lake dock poles (see BOM)
- A pancake style load cell providing an anchor point and positive/negative measurement

The Rocket:

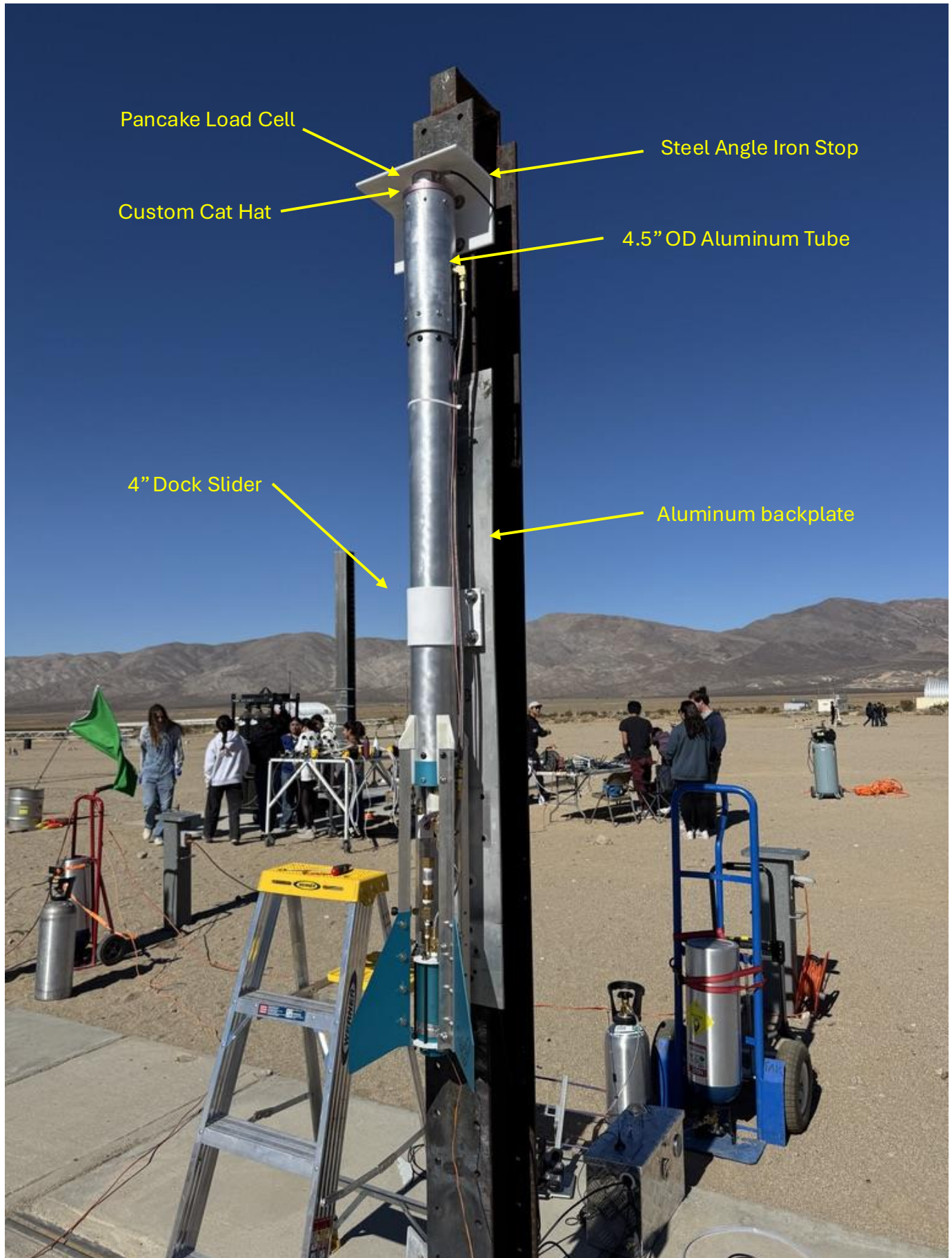
On the rocket we used a stock 4.5" OD aluminum tube with a cut-out that slides over the fuel bulkhead and bolts into the upper airframe nut ring. Then we have a custom machined "hat" that bolts into the aluminum tube and is secured into the load cell with a 16Mx1.5 threaded bolt. The hat also bolts into the aluminum tube for negative (gravity) retention. So, we just have the following two parts:

- A 4.5" OD / 4.0" ID x 12" long aluminum tube with cut-outs for the fuel line and indexed holes
- A custom machined "hat" with a 16M threaded hole and indexed holes for retention

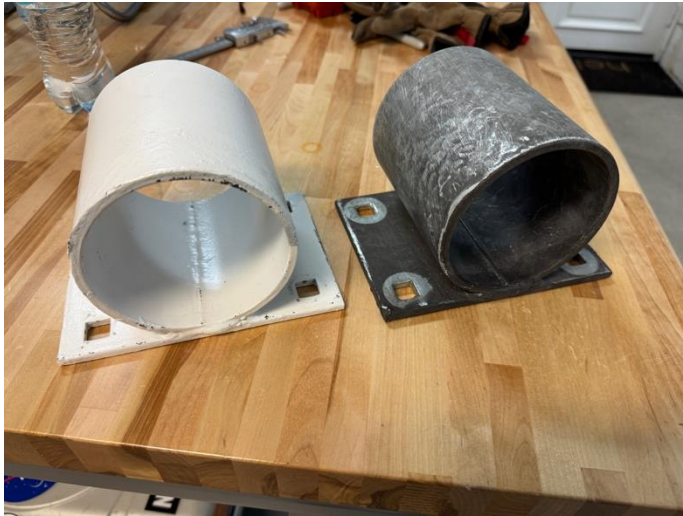
The rig bolts to the FAR large I-beams using 1/2" bolts (2"+ long) with a 4" x 4" x 4" pattern. We use 4 bolts on the aluminum back plate and 4 bolts on the steel angle stop.

Mike & Preston
@RocketTalk33 on the HC Discord

On the I-Beam



Dock Slider



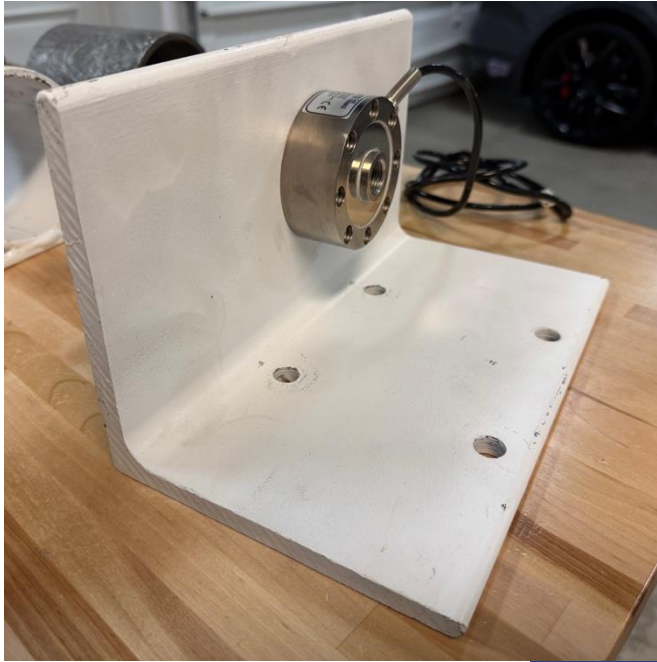
4" Dock Slider from DockHardware.com (part number DH PH-HO4).

The left one is cleaned up with the inside weld seam sanded down and painted. On the right is old one in our shop that has seen a few cat's. These things are tough!

We fasten these to the aluminum backplate using $\frac{1}{2}$ " bolts with the heads on the back of the plate and threads sticking up and we use one nut as a spacer (see photo below) to align to the stand-off height of the Mojave Sphinx.

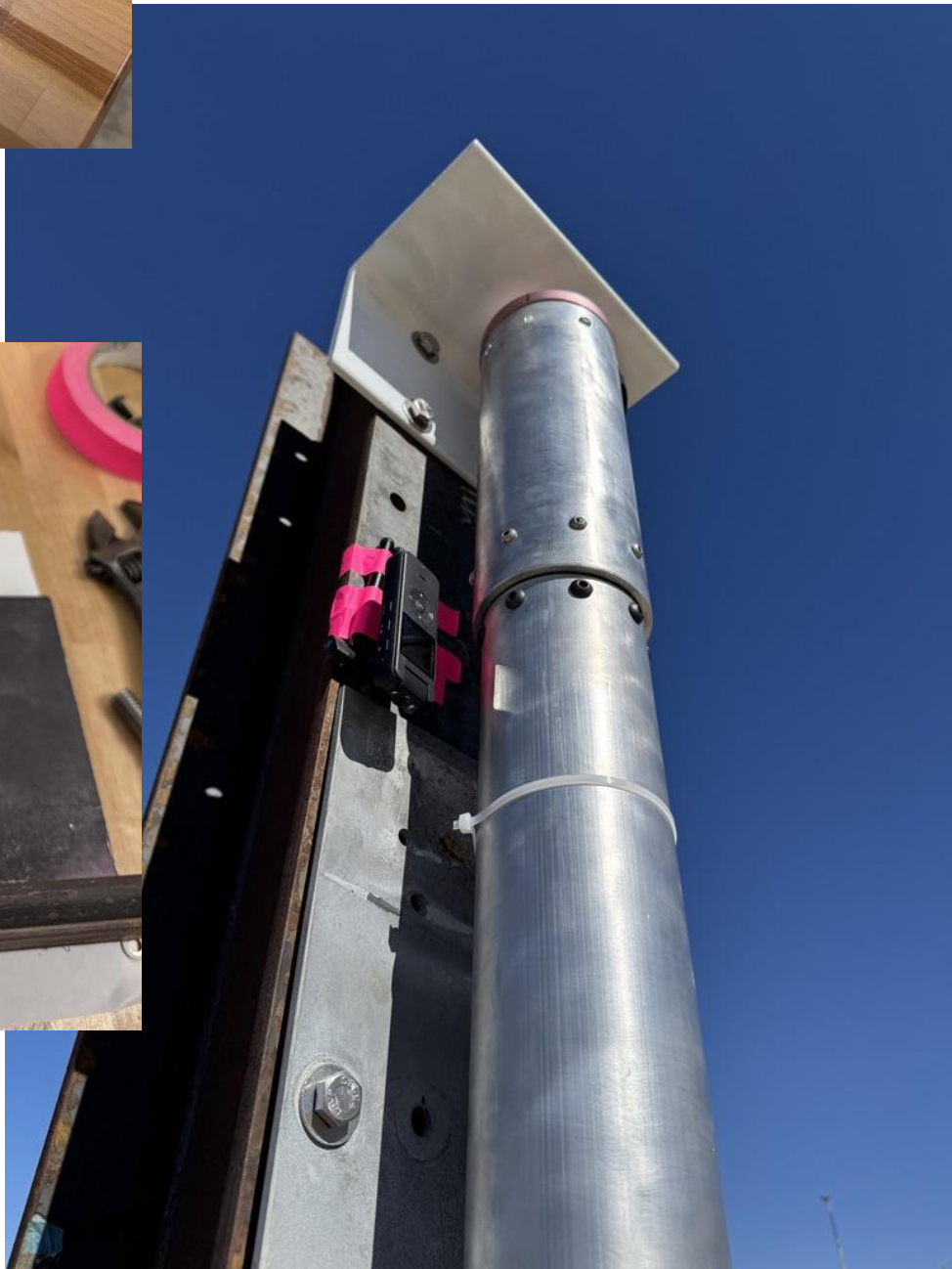
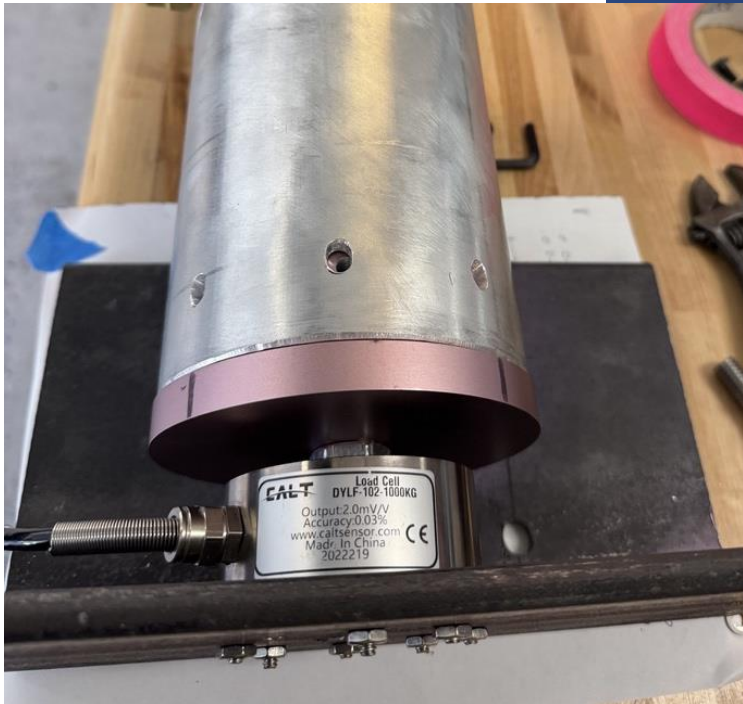


Steel Stop



This is a 6" x 6" x .4" steel 90 degree stop. Ours is 10" wide, but that's because we just pull any random rems from industrial metal supply. It only needs to be about 6" wide.

Note the 4"x4"x4" hole spacing for FAR I-beams (1/2" holes)



The "Cat Hat"



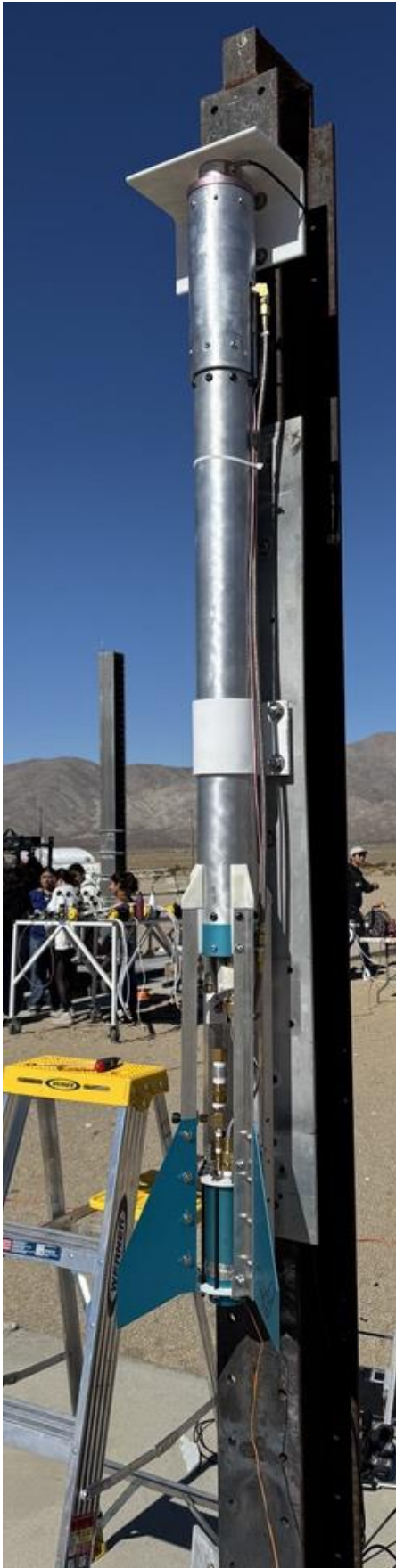
Our "Cat Hat" is two pieces designed to slip over the top of the fuel bulkhead assembly and the recovery bulkhead in the standard MS design. It is bulky and heavy, but worked well to distribute the weight and is easy and fast to assemble on-site.

The tube is stock aluminum 4.5" OD / 4.0" ID x 12" from McMaster Carr. We hacked out the slot for the fuel line using a 4" grinder with a carbon blade and index drilled the holes using a 3D printed guide to match the Mojave Sphinx upper airframe nut ring pattern.

The pink "hat" in the photo was a quick CAD hack sent out for machining. This version is embarrassingly oversized and feels like a brick, but it does the job. It has a M16 threaded hole down the center to match our pancake load cell center-threads and is indexed with $\frac{1}{4}$ "-20 threaded holes around the outside. It only needs 2-3 bolts at the top to hold the weight of the rocket before firing.



Order of Operation



Here is our order of operation to make test set up smooth:

Before you get to the I-beam (or at home/school):

1. Insert dock slider bolts into the backplate and secure with the spacer nuts
2. Ensure the load cell is bolted to the angle stop

I-Beam initial setup:

1. Attach the angle stop four bolts
2. Screw in the "cat hat" to the load cell (finger tight)
3. Attach the aluminum backplate with four bolts
4. Attach load cell to DAQ – test DAQ – prep GSE

Rocket setup:

1. Before filling fuel, with the fuel bulkhead off, slide the dock slider over the tank
2. Fill fuel and secure the fuel bulkhead then attach the 4.5" aluminum top tube using all seven lower bolts.

I-Beam rocket load (two people):

1. Secure the aluminum top tube to the cat hat using three bolts at the top
2. Align and secure the dock slider and secure with the four nuts
3. Secure the remaining connections for firing (N2O line, servo umbilical, etc.)

BOM / Sources

Here is a list of the stuff we used for our test stand

1. Aluminum backplate 55" x 8" x .25" (Rem from industrial metal supply)
2. Steel 90 degree stop – 6" x 6" x 10" wide x .4" thick (Rem from IMS)
3. 4" Dock Slider from DockHardware.com part DH PH-HO4 (link [here](#))
4. Aluminum tube 4.5" OD / 4.0" ID x 12" long (McMaster-Carr 9056K32)
5. Custom machined "hat" insert
6. ½" x 2" fasteners x 12 - bolts, nuts, washers (with 4 extra nuts for spacing)
7. Pancake load cell (ours is 1000Kg, but smaller is fine for HC) Amazon link [here](#)